

IDENTIFICATION OF PASSIFLOWERS IN NEW ZEALAND (DICOTYLEDONES : PASSIFLORACEAE)

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Abstract. The species and cultivars of *Passiflora* grown in New Zealand are keyed and illustrated.

The Passifloraceae or Passionflower family, found mainly in the tropics, has 23 genera, and about 680 species of which nearly 500 belong to the genus *Passiflora* (Hutchinson 1967, p. 364). Only one member of the family belongs to the indigenous flora of New Zealand. This species has been known as *Tetrapathaea tetrandra* (DC.) Cheesem. (Fig. 1), but Hutchinson (ibid. p. 371) treats *Tetrapathaea* as a synonym of *Passiflora*.

In the following pages the *Passiflora* species and cultivars commonly grown in New Zealand are keyed and illustrated. The identification of these plants is difficult because some of the morphological characters are inconstant, and the necessary literature is not readily available.

Acknowledgements. I am indebted to the Director and staff of the Herbarium of the Royal Botanic Gardens, Kew, and particularly to Mr. Peter Green, for photocopies of Masters' 1871 and 1877 papers, other relevant descriptions and illustrations, and identifications of voucher specimens. I must also thank Dr. E. E. Chamberlain, Director, Plant Diseases Division, DSIR, Mt Albert, for allowing me the use of facilities at the station to carry out trials; Dr. R. C. Cooper, Botanist, Auckland Institute and Museum, for help in identifying and describing *Passiflora* specimens; Miss J. H. Goulding, Associate Botanist at the Museum, for drawings; Messrs. G. D. Palmer (A. W. Palmer & Sons Ltd.), D. Gay, J. Goodwin, and P. R. Beal (Redlands Horticultural Research Station, Queensland), for plants and seed; Miss J. M. Dingley, Dr. R. F. R. McNabb, Mrs. R. M. Davison, all of Plant Diseases Division, and Mr. W. A. Fletcher, Department of Agriculture, Auckland, for advice and assistance.

PASSIFLORA L.

This description has been prepared for the species commonly grown in New Zealand gardens. It does not apply to all the species of the genus, and it does not include the indigenous *P. tetrandra* Sol. ex DC. *Passiflora tetrandra* is anomalous in having unisexual, ebracteate, 4-partite flowers.

Lianes, herbaceous to woody, climbing by solitary axillary tendrils. Stems terete or angled. Stipules filiform or pinnatifid or leafy. Petioles terete or caniculate above, often with stalked or sessile glands. Flowers (Fig. 2) axillary, usually solitary, bisexual. Peduncles jointed, usually bearing an involucre of three bracts below the flower, the bracts free or partially connate. Calyx of 5 sepals,

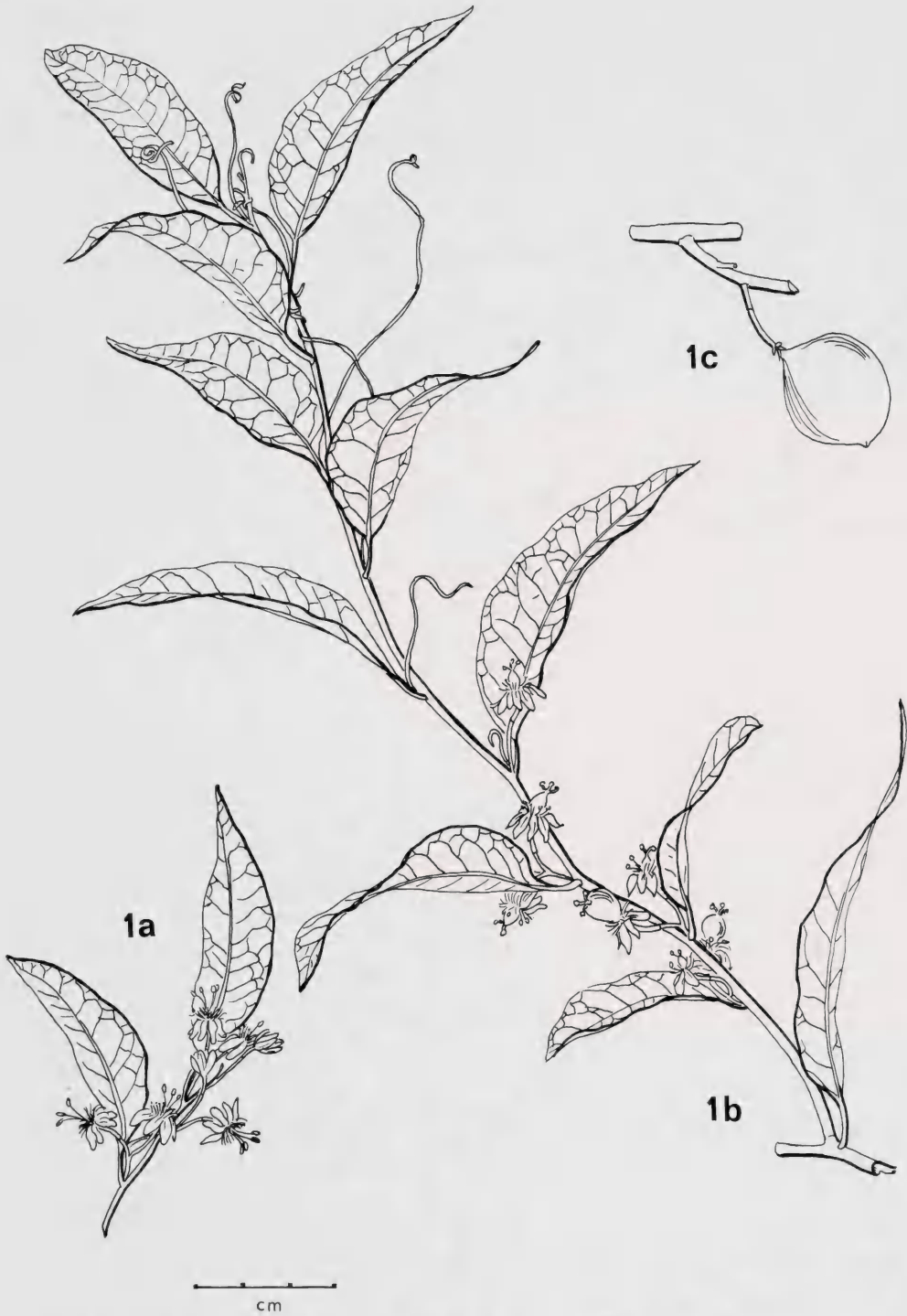


Fig. 1. *Passiflora tetrandra* Sol. ex DC. Redrawn from Raoul 1846, pl. 27.
1a. male flowers; 1b. flowering branch with female flowers; 1c. fruit.

fused at the base and for part of their length to form a disc or cup or tube, within which there is a limen, nectar ring, operculum, corona of one or more series of filaments of tubercles, and a corolla of 5 petals alternate with the sepals. Gynophore elongated. Stamens 5, with filaments fused to the gynophore below, free above. Styles 3, stigmas capitate. Fruit ovoid or globose, varying in colour from green to yellow to orange or purple, usually with fleshy sometimes edible pulp. Seeds numerous.

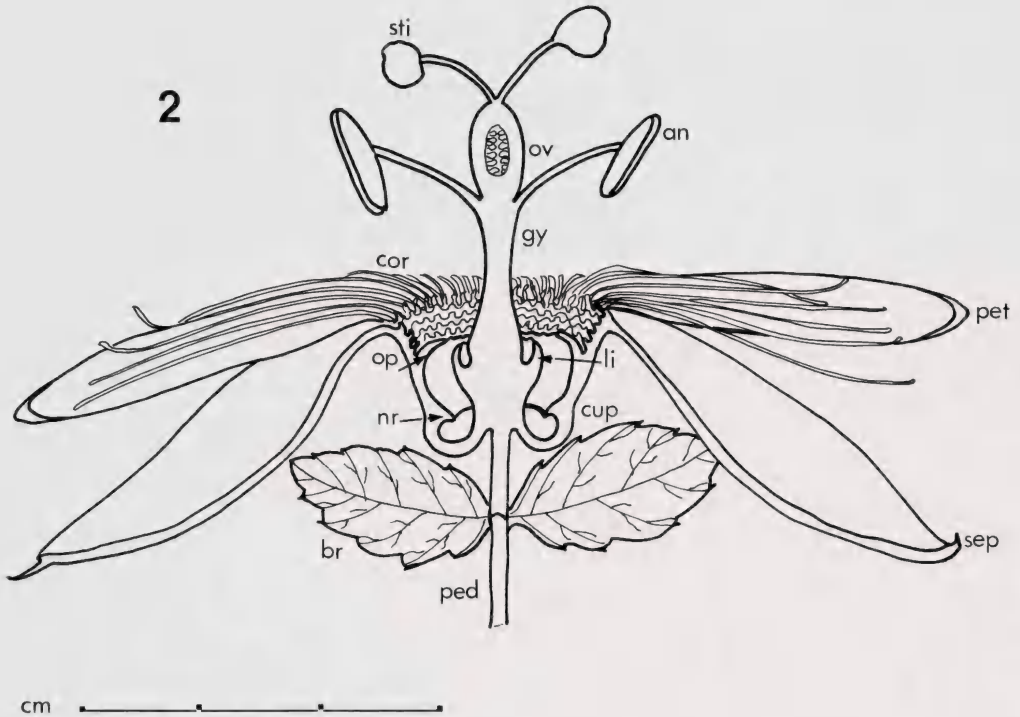


Fig. 2. Flower of *Passiflora edulis* Sims

sti stigma; **ov** ovary; **an** anther; **gy** gynophore; **li** limen; **cup** cup (or receptacle or hypanthium or calyx tube); **nr** nectar rim (or ring or annulus); **cor** corona, consisting of series of radii (or filaments) and pali (or tubercles); **op** operculum; **sep** sepal; **pet** petal; **ped** peduncle; **br** bract.

This key is designed to separate only the species and cultivars commonly grown in New Zealand gardens. Vegetative characters have been used as far as possible, but it is impossible to define some species and cultivars without reference to the flowers and fruits.

- a Leaves of adult foliage entire, broadly ovate; petals white; fruit ovoid, to 8 cm long, orange brown or purplish with white specks, pulp white. 1. *P. ligularis*
- aa Leaves bilobed or 3- to 9-lobed:
 - b Leaves bilobed; petals pink above; fruit unknown. 2. *P. sanguinolenta*
 - bb Leaves 3-lobed (5-lobed in *P. caerulea* and *P. 'Eynsford Gem'*):
 - c Petioles without glands; petals cinnabar red above; fruit subglobose, to 5.5 cm long, green, with colourless pulp. 3. *P. cinnabarina*

- cc Petioles with glands*:
 - d Stipules filiform*:
 - e Stipules simple, subulate:
 - f Petioles glabrous, with two glands near the base of the leaf; petals white above; fruit globose or ovoid, to 5 cm long, yellow-green or purple, with yellow-orange pulp. 4. *P. edulis*
 - ff Petioles hirtellous*, with up to 12 glands throughout; petals cerise above; fruit fusiform, ribbed, to 12 cm long, cream-yellow, with cream pulp. 5. *P. antioquiensis*
 - ee Stipules pinnatifid:
 - g Anther filaments free from just below the ovary; leaves white lanate below; petals rose pink above; fruit subglobose, to 6 cm long, yellow, with colourless pulp. 6. *P. pinnatistipula*
 - gg Anther filaments free from half way up the gynophore; leaves greyish brown tomentose below; petals crimson above; fruit not seen, but said to be up to 8 cm long. 7. *P. rosea*
 - dd Stipules foliaceous:
 - h Leaves and ovaries usually pubescent; bracts partially connate, forming a tubular involucre simulating an additional calyx; calyxes tubular:
 - i Petioles with 8 to 12 sessile glands; leaves downy on both surfaces; bracts to 3 cm long, united for about half their length; petals rose pink above; fruit ellipsoid, 7 to 12 cm long, yellow, with yellow-orange pulp. 8. *P. mollissima*
 - ii Petioles with 4 to 8 stipitate or subsessile glands; leaves glabrous above, usually pubescent below; bracts to 5 cm long, united for about three-fourths of their length; petals orange above; fruit ellipsoid, to 6 cm long, yellow-green, with cream-yellow pulp. 9. *P. mixta*
 - hh Leaves and ovaries glabrous, leaves sometimes glaucous; bracts free; calyxes cup-shaped:
 - j Leaves 5-lobed (occasionally 3- or 7- or 9-lobed), lobes narrowly elliptic:
 - k Leaves 4 to 12 cm long; tendrils to 25 cm long; petals pink or white above; fruit ovoid, to 6 cm long, orange, with red pulp. 10. *P. caerulea*
 - kk Leaves to 7 cm long; tendrils to 5 mm long, often not developed; petals lilac above; fruit not formed. 11. *P. 'Eynsford Gem'*
 - jj Leaves 3-lobed, lobes broadly elliptic, up to 12 cm long and 14 cm wide; petals pink above; fruit not formed. 12. *P. x alato-caerulea*

* In studying glands, stipules and pubescence, it is necessary to use a lens. It is also desirable to study ample young material as stipules may be shed on old or dried specimens.

NOTES ON THE SPECIES AND CULTIVARS

1. *Passiflora ligularis* Juss.

Figs. 3 - 5

This species is easily recognised by the entire, broadly ovate leaves, long slender petiolar glands, and the large edible fruit. The flowers are up to 10 cm in diameter, with white petals and a colourful corona of filaments striped purple, blue and white. It is a native of Central and South America.

Seed for this study was obtained from Mr. McLisky's garden at Titirangi. The species has been observed on Kawau Island, and Mr. W. Sykes (personal communi-

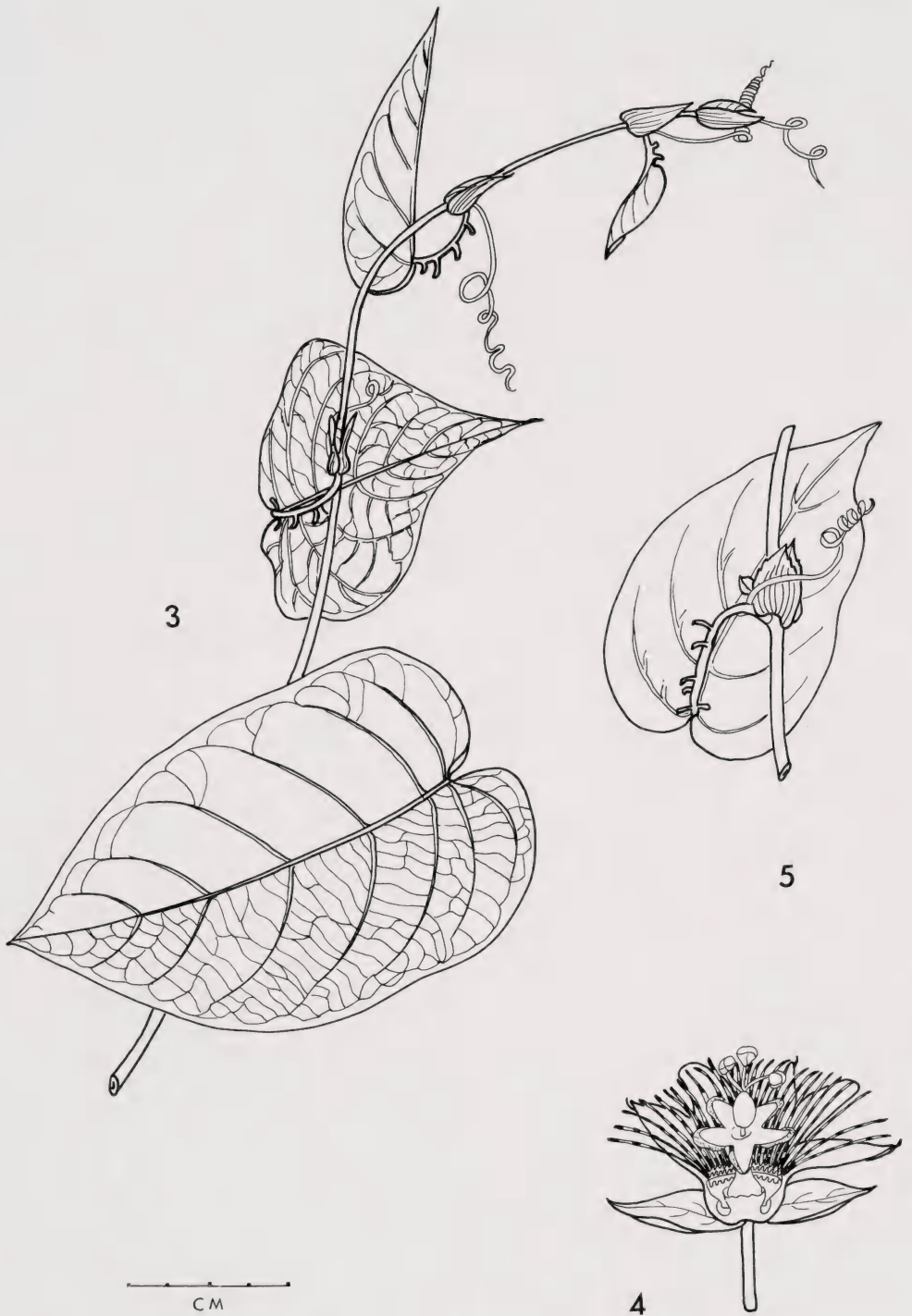


Fig. 3 Leaves of *P. ligularis* Juss.; 4 longitudinal section of a flower; 5 node with leafy stipules, tendril, and leafstalk bearing long slender glands.

cation) reports it growing at Whangarei. Mr. W. Fletcher (personal communication) reports that an old fruiting plant is growing at Kerikeri. As the species is extremely frost tender it is grown only in the warmer districts of New Zealand.

Identification has been made from the descriptions of Killip (1938, p. 344) and Standley and Williams (1961, p. 133), and the illustrations in Popenoe (1924, pl. 43) and Degener (1934, Fam. 250).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 116157 McLisky's garden, Titirangi, B. R. Young, Mar 1966 (fl.).
- 116158 PDD, Mt Albert, B. R. Young, Mar 1966 (sterile).
- 116086 same locality and collector, Mar 1967 (sterile).
- 120483 Gladstone Road, Parnell, M. Goodey, May 1969 (fl.).

2. *Passiflora sanguinolenta* Mast.

Figs. 6 - 8

This species is distinguished by the bilobed leaves. The stems are angled and hairy. The flower stalks do not bear bracts. The flowers are up to 6 cm in diameter, star-like, and pink coloured. Fruit have not developed on any of the plants observed in this study and neither Masters nor Killip described them. The species is a native of the mountains of Ecuador.

I have not found *P. sanguinolenta* in the early New Zealand nursery catalogues available to me, but D. Hay & Son, Montpellier Nurseries, Hobson Bay, Auckland, offered plants for sale in their 1924 and subsequent lists.

Material for this study was obtained from Mr. McLisky's garden at Titirangi, and from the nursery of A. W. Palmer & Sons Ltd.

Identification has been made from the following descriptions and illustrations: Masters 1868, p. 1162, and 1874, p. 226, fig. 47; Harms 1894, fig. 25c, and 1925, fig. 218c; J. D. Hooker 1900, tab. 7751; and Killip 1938, p. 253.

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 116083 and 116176 PDD, Mt Albert, ex Palmer's Nursery, B. R. Young, Mar 1966 (fl.). A duplicate of 116083 sent to Kew was identified as *P. sanguinolenta* Mast.
- 116175 McLisky's garden, Titirangi, B. R. Young, Apr 1966 (fl.).
- 117559 PDD, Mt Albert, ex McLisky's, B. R. Young, Jan 1968 (fl.).
- 117560 PDD, Mt Albert, ex M. Goodey's garden, Judges Bay Road, Parnell, B. R. Young, Jan 1968 (fl.).

3. *Passiflora cinnabarina* Lindl.

Figs. 9 - 11

This Australian species is differentiated from *P. sanguinolenta* by its palmate 3-lobed leaves and from other species in New Zealand by the scattered threadlike bracteoles on the peduncles. The star shape of the flowers, which are about 7 cm in diameter, is due to the long narrow sepals and shorter petals. The fruit are subglobose, up to 5.5 cm long, green in colour and inedible. The species is a native of New South Wales and Victoria.

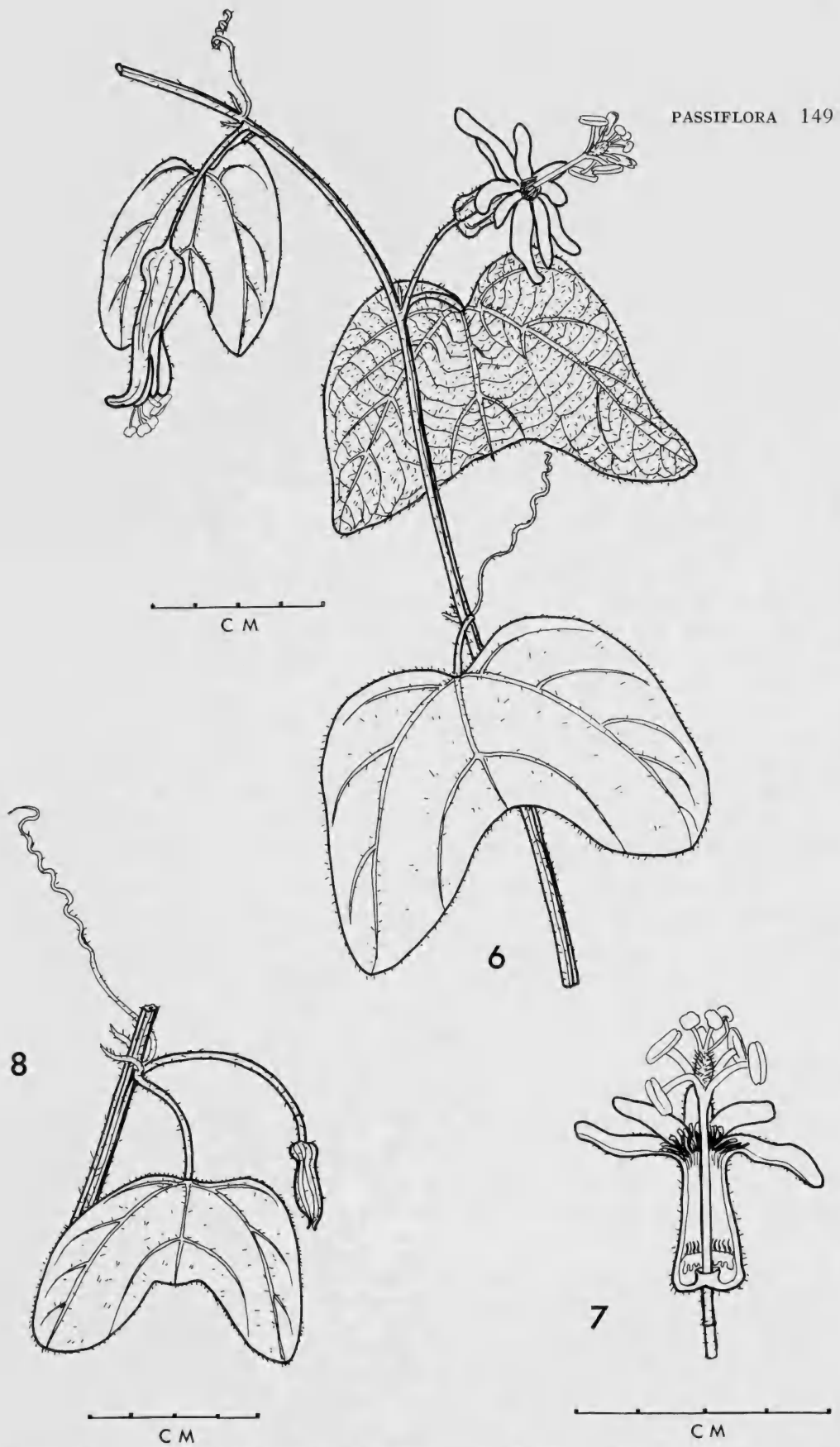


Fig. 6 Flowering branch of *P. sanguinolenta* Mast.; 7 longitudinal section of a flower; 8 node, showing the angled stem, subulate stipules, a tendril, leaf and flower bud.

Seed for this study was obtained from Australia, and seed and cuttings were collected from Parker Road, Oratia, where the species is a 'garden escape'. Mr. W. Sykes (personal communication) reports that it is growing in Wanganui and possibly in Hastings.

Identification has been made from Oliver 1871, tab. 5911.

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 116082 PDD, Mt Albert, ex Australia, B. R. Young, Jan 1967 (fl.).
 116177 Parker Road, Oratia, B. R. Young, Mar 1966 (sterile).
 116178 PDD, Mt Albert, ex Oratia, B. R. Young, Mar 1966 (sterile).
 117466 same locality and collector, Nov 1967 (fl.).
 117575 same locality and collector, Dec 1967 (fl. and fr.). A duplicate of 117575 sent to Kew was identified as *P. cinnabarina* Lindl.
 117964 Garden escape at Parker Road, Oratia, Mrs. S. Davison, Sept 1965 (fl. and fr.).

4. *Passiflora edulis* Sims

Figs. 12 - 15

This species is distinguished by its bristle-like stipules, glabrous 3-lobed leaves, and the two glands on the petiole near the base of the leaf. The flowers are white, up to 7 cm in diameter, with wavy white corona filaments banded with purple near the base. The fruit are globose to ovoid, up to 5 cm long, green, yellow, brownish purple or dark purple, with yellow-orange edible pulp. The species is a native of Brazil.

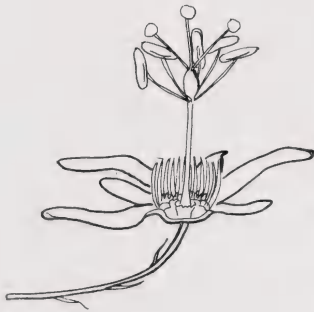
There is considerable variation in the colour, polish and shape of the leaves, the presence of glands, the length and purpling of the corona, and the shape and colour of the fruit. Last century several authors described the variants as species, but Masters (1871, p. 637) reduced these to varieties. Killip (1938, p. 396) noted two distinct flower forms but, as they are not correlated with the differences in vegetative characters, he preferred not to assign formal names to them.

At least three varieties are grown here at present:—

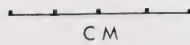
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|--|---|
| Stems always green; fruit purple. | 1. <i>P. edulis</i> var. <i>edulis</i> |
| Stems often reddish; fruit green, yellow or greenish purple: | |
| Styles spotted with purple; fruit green or greenish purple. | 2. <i>P. edulis</i> var. <i>rubricaulis</i> |
| Styles whitish green; fruit yellow. | 3. <i>P. edulis</i> forma <i>flavicarpa</i> |

Passiflora edulis Sims var. *edulis* has been cultivated in New Zealand since 1872 or earlier (Hay 1872, p. 42). The first large commercial plantings were made at Kerikeri, Bay of Islands, in 1927 as a 'stop gap' when establishing citrus orchards. During the years 1927 to 1935, 20,000 vines (60 acres) were interplanted on trellises with citrus. As crops more than fulfilled the local demand, growers tried cool storing and shipping the fruit as well as freezing and canning the pulp. A commercial company took over the pulping factory and, in 1935, successfully marketed 4,600 gallons of pulp in the United Kingdom (Anon. 1934, p. 9). Soon, passionfruit became the main crop of a number of Kerikeri growers, and their success led others to plant orchards at Auckland and Tauranga.

At this time no disease of any consequence was present, but ten years later the yield had been reduced to about a tenth; grease spot, a bacterial disease caused by *Pseudomonas passiflorae* (Reid) Burkholder, and brown spot a fungous disease caused by *Alternaria passiflorae* Simmonds, had become common, killing a large number of plants and making the fruit unmarketable.



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Fig. 9 Flowering branch of *P. cinnabarina* Lindl.; 10 longitudinal section of a flower; 11 fruit.

Although these two diseases and root rot restricted passionfruit culture about Auckland, plantings in the Bay of Plenty district were relatively successful. By 1950, this district had become the main production area, and the industry expanded there until 1960 when 190 tons of fruit were produced. In recent years, however, production has declined, e.g., to 75 tons in 1964, and growers have replaced passionfruit with more disease-resistant crops. As well as grease spot, brown spot and root rot, the fungous diseases, crown canker, *Fusarium sambucinum* Fekl., and septoria blotch *Septoria passiflorae* Louw., are now of major importance, causing loss of plants and fruit each season.

In the hope of obtaining disease-resistant plants, growers have recently imported other varieties. *Passiflora edulis* Sims var. *rubricaulis* (Jacq.) Mast., obtained from Brazil by Mr. Johansen, a nurseryman of Te Atatu, is an extremely vigorous variety. In cultivation, the stems vary in colour from red to green, the coronal bandings from pale to bright purple, and the fruit from green to purplish brown. At one extreme, these characters resemble those of var. *edulis* and, at the other, they approach those of forma *flavicarpa*. This variety is much hardier than forma *flavicarpa*, however, and will tolerate frosts up to 5° F.

Pope (1935, p. 13) has recorded that a Mr. E. N. Reasoner of Florida obtained seed of a passionfruit in Australia and passed some on to the Hawaii Experiment Station in 1923. The Station submitted specimens and photographs to E. P. Killip, who identified them as a yellow-fruited form of *P. edulis* (Pope, *ibid.* p. 2). Later, the plants were described and named as *P. edulis* Sims forma *flavicarpa* by Degener (1932, Fam. 250). This form is frost tender and will grow only in well-sheltered positions. It does not seem to be suitable for commercial plantings in New Zealand.

Material for this study was obtained from plants grown at the Plant Diseases Division, DSIR, Mt Albert. Plants of var. *edulis* were raised from seed collected at a commercial planting near Te Puke, var. *rubricaulis* from seed given by Mr. Johansen, and forma *flavicarpa* from seed sent by the Redlands Research Station, Australia.

Identifications have been made from the following literature:—

Passiflora edulis Sims var. *edulis*: Sims 1818, tab. 1989; Masters 1872, p. 610 and tab. 122, fig. 1; Killip 1938, p. 393.

var. *rubricaulis* (Jacq.) Mast.: Jacquin 1844, tab. 169; Masters 1871, p. 637.

forma *flavicarpa* Degener: Degener 1932, Fam. 250; Pope 1935, fig. 3.

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

Passiflora edulis Sims var. *edulis*

44160 Near Meteorological station, Raoul Island, R. C. Cooper. June 1956.

114206 PDD, Mt Albert, B. R. Young, Mar 1967 (seedling).

115947 same locality and collector, May 1967 (fl.).

117875 same locality and collector, Apr 1968 (fl.). A duplicate of 117875 sent to Kew was identified as *P. edulis* Sims.

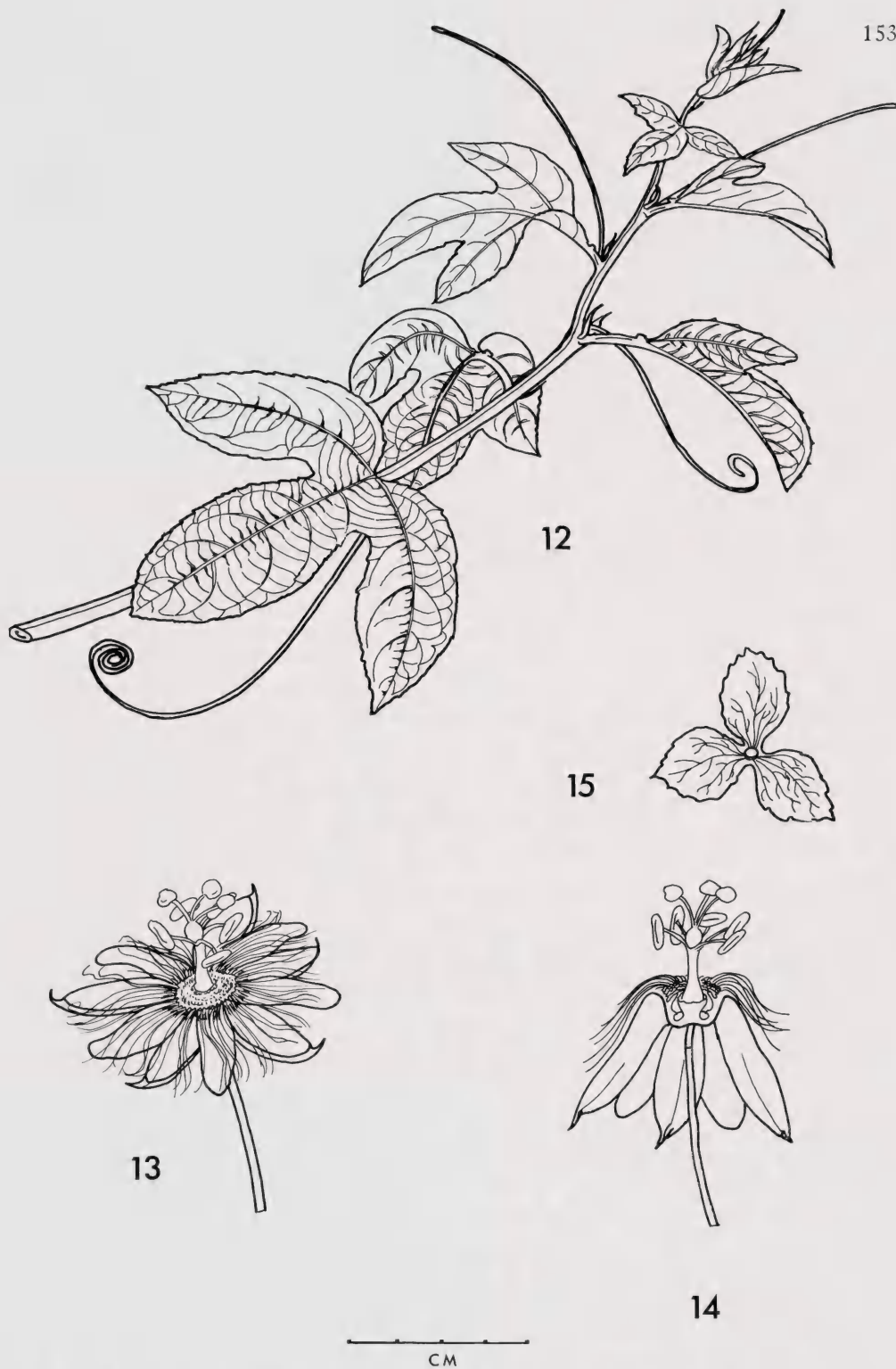


Fig. 12 Flowering branch of *Passiflora edulis* Sims var. *edulis*; 13 fully opened flower; 14 longitudinal section of a flower; 15 bracts. See also Fig. 2.

var. *rubricaulis* (Jacq.) Mast.

- 114199, 114207, 114210, 114211. PDD, Mt Albert, red-stemmed and green-stemmed seedlings from red-stemmed, green-fruited parent, B. R. Young, Mar 1967.
 114209 PDD, Mt Albert, red-stemmed (streak of red only) seedling, B. R. Young, Mar 1967 (fr. green).
 114974 PDD, Mt Albert, red-stemmed seedling, B. R. Young, 1966 (fl., fr. green and greenish purple). A duplicate of 114974 sent to Kew was identified as *P. edulis* Sims.
 115712, 115713, 115951. PDD, Mt Albert, red- and green-stemmed seedlings with glands on the margins of the bracts, B. R. Young, May 1967 (fl.). Similar glands are present on 114974 and 116087; c.f. *P. verrucifera* Lindley (1840, tab. 52), which was transferred to *P. edulis* Sims as var. *verrucifera* (Lindl.) Mast. (1871, p. 637), and finally reduced to synonymy by Killip (1938, p. 393).
 116087 Roberts Road, Te Atatu, parent plant of seedlings, B. R. Young, Aug 1966 (fl.).

forma *flavicarpa* Degener

- 30119 Mokuleio, Oahu, Hawaii, cultivated, O. & I. Degener, Sep 1965 (fl.).
 114197, 114198, 114200. PDD, Mt Albert, B. R. Young, Mar 1967.

5. *Passiflora antioquiensis* Karst.

Figs. 16 - 18

This species is easily distinguished from others present in New Zealand by the cerise flowers which hang on pubescent stalks up to 20 cm in length. The palmate, deeply 3-lobed leaves are covered in brownish hairs. The flowers, up to 12 cm in diameter, have a calyx tube to 6 cm in length with the corona reduced to pinkish tubercles. The creamish-yellow fruit are spindle-shaped, to 12 cm long, and markedly longitudinally ribbed. The pulp is cream in colour, with a distinctive vanilla flavour which is more pleasant than that of other banana passionfruit. In New Zealand, this species is called the vanilla or red banana passionfruit. It is a native of the mountains of Colombia.

For many years, this species was known as *Tacsonia* or *Passiflora van-volxemii*, and it was offered for sale under that name (e.g. Hay 1872, p. 43). Unfortunately it is frost tender and a shy bearer.

Material for this study was obtained from Mr. W. Fletcher's garden at Hillsborough, Auckland, and Dr. R. C. Cooper's garden at Parnell, and from specimens collected at Paihia, Bay of Islands, by Dr. R. Cumber.

Identification was made from the description in Killip (1938, p. 302) and the illustration in Masters (1877, pl. 6).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 116085 524 Parnell Road, Miss J. Cooper, Jan 1967 (fl. and fr.).
 116159 Hillsborough, W. A. Fletcher, Apr 1966 (fl.).
 116160 Mt Albert, J. Leith, Mar 1966 (fl.). A duplicate of 116160 sent to Kew was identified as *P. antioquiensis* Karst.
 116161 Paihia, Bay of Islands, R. Cumber, Mar 1966 (sterile).

6. *Passiflora pinnatistipula* Cav.

Figs. 19 - 22

Of the species present in New Zealand, only two, *P. pinnatistipula* and *P. rosea*, produce pinnately branched stipules. In *P. pinnatistipula* the leaves are leathery, green and glabrous above, and white lanate beneath. The pink flowers, 10 to 12 cm in diameter, have a calyx tube up to 5 cm long and a filamentous violet blue corona.



Fig. 16 Flowering branch of *P. antioquiensis* Karst.; 17 longitudinal section of a flower; 18 fruit.

The three bracts at the base of the flower are free. Yellow subglobose fruit, up to 6 cm long, are borne sparingly on the plants observed. The species is a native of Colombia, Ecuador, Peru and Chile.

Material for this study was obtained from plants at Plant Diseases Division, DSIR, Mt Albert, grown from seed collected by Mr. C. A. Techer, Dunedin, and from a plant in Mr. Smith's garden, Massey, Auckland.

Identification has been made from the illustrations in Paxton (1834, p. 249 and pl.) and W. J. Hooker (1844, tab. 4062), and the description of Killip (1938, p. 276).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 114201-3 PDD, Mt Albert, B. R. Young, Mar 1967 (fl.).
 115180 same locality and collector, Apr 1967 (fr. yellow).
 115709 same locality and collector, May 1967 (fl. and fr.). A duplicate of 115709 sent to Kew was identified as *P. pinnatistipula* Cav.
 116163, 116165 Chorley Avenue, Massey, J. G. Smith, Apr 1966 (fl.).

7. *Passiflora rosea* (Karst.) Killip

Figs. 23 - 28

This plant is remarkable in having the anther filaments free from half way up the gynophore instead of just below the ovary. The leaves differ from those of *P. pinnatistipula* in their softer texture, broader lobes, and the greyish brown tomentum beneath. The flowers are similar to those of *P. pinnatistipula* in the calyx tube up to 5 cm long and the deep violet corona filaments, but differ in the anther filaments and the crimson petals.

Killip (1938, p. 280) considered that *P. rosea* is a hybrid between *P. pinnatistipula* and *P. mollissima*. He observed it growing wild near Tarma, Peru, with the two reputed parents nearby. He recorded that it occurs as a cultivated plant, or wild as a natural hybrid, from Colombia to Peru. In New Zealand, it is grown occasionally as an ornamental climber. Fruit has not been observed here, but Killip (ibid. p. 279) described them as ovoid and 8 cm long.

Plants for this study were raised at Plant Diseases Division, DSIR, Mt Albert, from cuttings collected by Mr. J. W. Goodwin at Pukekura Park, New Plymouth, where it was incorrectly known as *P. coccinea*, and from cuttings given by Wilson's Nurseries, Gisborne.

Identification has been made from Killip (1938, p. 278).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 116167 Pukekura Park, New Plymouth, ex Duncan & Davies Ltd., J. W. Goodwin, Apr 1966 (sterile).
 117573 PDD, Mt Albert, grown from cuttings ex Pukekura Park, B. R. Young, Oct 1967 (fl.). A duplicate of 117573 sent to Kew was identified as *P. x rosea* (Karst.) Killip. In the flowers of this plant the anther filaments are free from half way up the gynophore (Fig. 25).
 117574 PDD, Mt Albert, grown from cuttings ex Wilson's Nurseries, Gisborne, Oct 1967 (fl.). In the flowers of this plant the anther filaments are free from above the middle of the gynophore (Fig. 26) and the petals are lighter in colour.

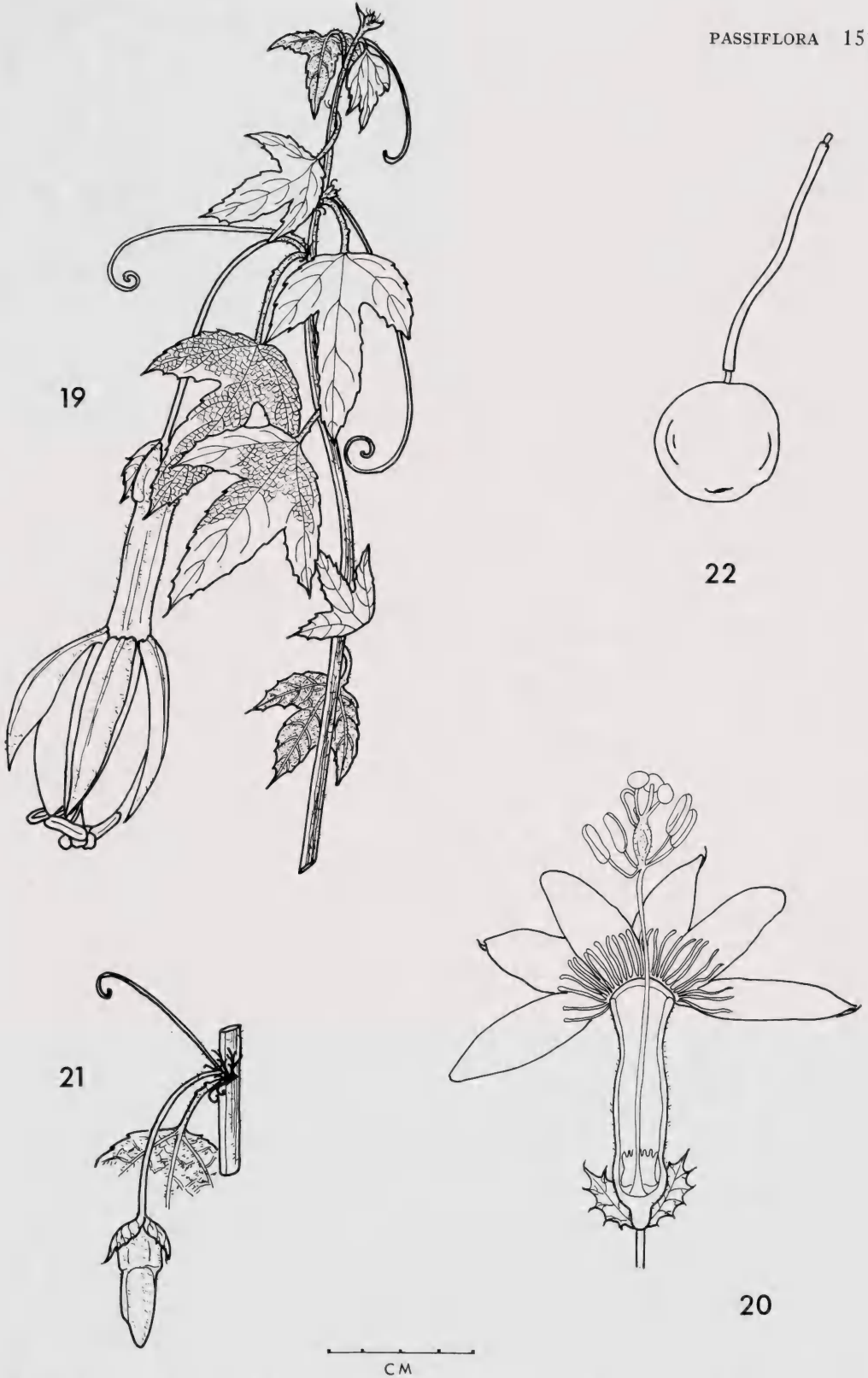


Fig. 19 Flowering branch of *P. pinnatistipula* Cav.; 20 longitudinal section of a flower; 21 node with pinnatifid stipules, a tendril, leaf and bud; 22 fruit.

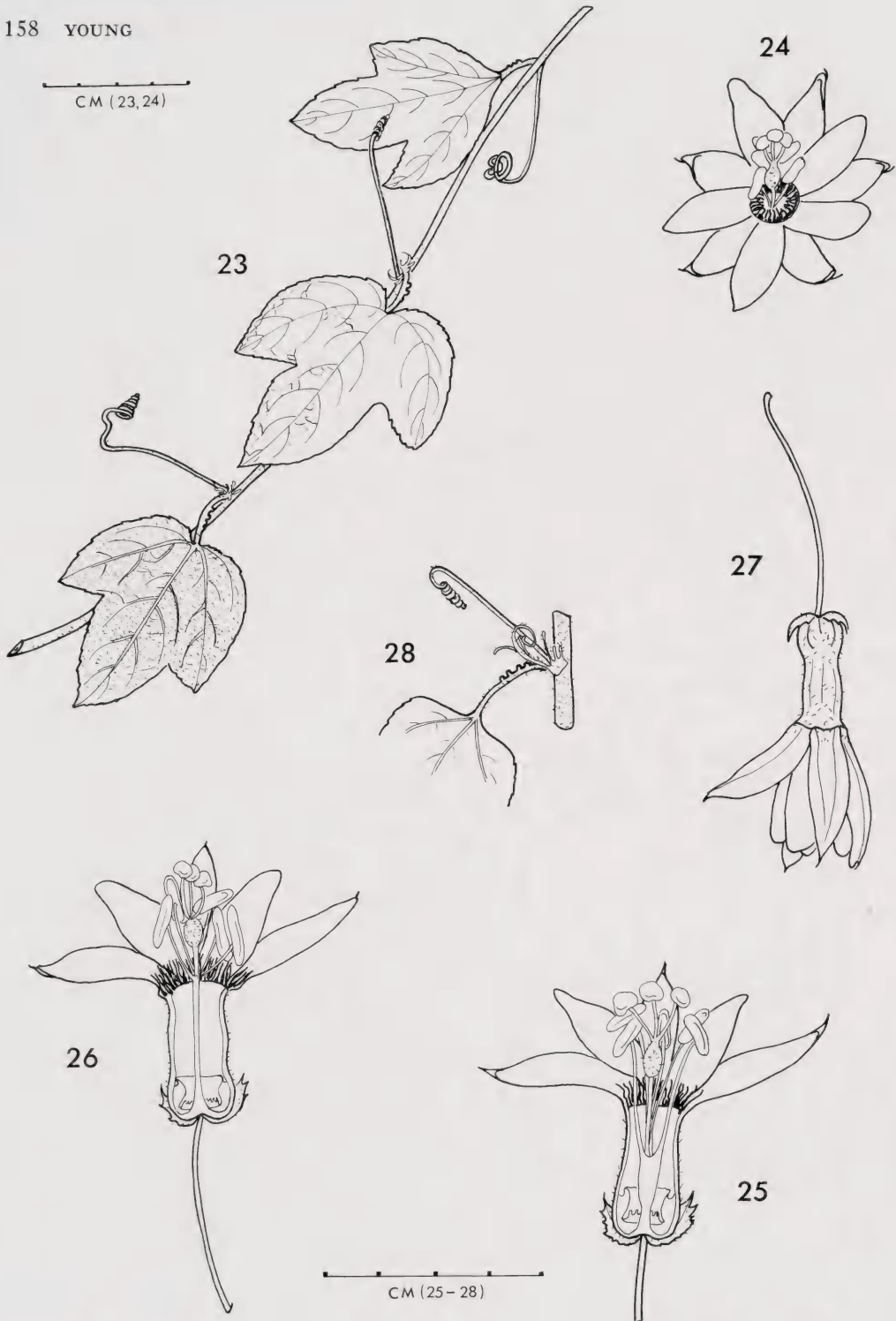


Fig. 23 Leaves of *P. rosea* (Karst.) Killip; 24 flower; 25 longitudinal section of a flower of specimen 117573; 26 l.s. of a flower of specimen 117574; 27 flower bud; 28 node with pinnatifid stipules, a tendril and leaf.

8. *Passiflora mollissima* (HBK.) L. H. Bailey

Figs. 29 - 32

This species and *P. mixta* are separated without difficulty from *P. pinnatistipula* and *P. rosea* by their leafy stipules. They are distinguished from other species with foliaceous stipules (e.g. *P. caerulea*) by the presence of hairs on the leaves and ovaries, their long tubular calyxes, and the involucre bracts which simulate an additional calyx.

Passiflora mollissima is distinguished from *P. mixta* in having 8 to 12 more or less sessile glands on the petiole, leaves downy on both surfaces, and bracts up to 3 cm long, united for about half their length to form an involucre. The petals are rose pink above, and the fruit are ellipsoid, 7 to 12 cm long, yellow, with yellow-orange pulp. The species is a native of Venezuela, Colombia, Peru and Bolivia, and it is cultivated extensively in the Andes. It was offered for sale in New Zealand last century (Hay, 1872, p. 43) under its old name of *Tacsonia mollissima*, but it is found now only as a garden escape in Nelson and the West Coast of the South Island.

Material for this study was collected at Ruby Bay, Nelson, by Mr. D. Gay, and at the Pancake Rocks, Punakaiki, Westland, by the author.

Identification has been made from the descriptions and illustrations of W. J. Hooker (1845, tab. 4187), Paxton (1846, p. 25 and pl.), Popenoe (1924, p. 125, pl. 44), and Killip (1938, p. 291).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

116088, 116170 Ruby Bay, Nelson, D. Gay, Mar 1966 (fl. and fr.).

116089 PDD, Mt Albert, seedling of Ruby Bay plant, B. R. Young, June 1967 (sterile).

117584 Pancake Rocks, Punakaiki, Westland, B. R. Young, Feb 1968 (fl.).

117874 PDD, Mt Albert, B. R. Young, Apr 1968 (fl. and fr.).

Duplicates of 116088 and 117874 sent to Kew were identified as *P. mollissima* (HBK.) L. H. Bailey.

Killip (1938, p. 293) mentioned that *P. mollissima* seemed to cross freely with other species. Plants collected in New Zealand that combine some of the characters of *P. mollissima*, *P. mixta*, and possibly *P. pinnatistipula*, are listed at the end of the section on *P. mixta*. Numbers 116084, 116173 and 116174 listed there are representative of a form that is widely grown in frost-free areas of New Zealand for its ornamental beauty and edible fruit, and that is known in the nursery trade here as *P. mollissima* or the yellow banana passionfruit. Possibly it has replaced the true *P. mollissima* in gardens because of the better quality of its fruit.

9. *Passiflora mixta* Linn.f.

Figs. 33 - 35

This species is distinguished from *P. mollissima* in having 4 to 8 stipitate or subsessile glands on the petiole, leaves glabrous above and sparsely hairy beneath, and bracts up to 5 cm long, united for about three-fourths of their length. The petals are described by Killip (1938, p. 295) as pink to orange red, and are a glowing orange in our specimens. The fruit are ellipsoid, to 6 cm long, yellow green with cream-yellow pulp. The species is a native of Venezuela, Colombia, Ecuador, Peru and Bolivia.

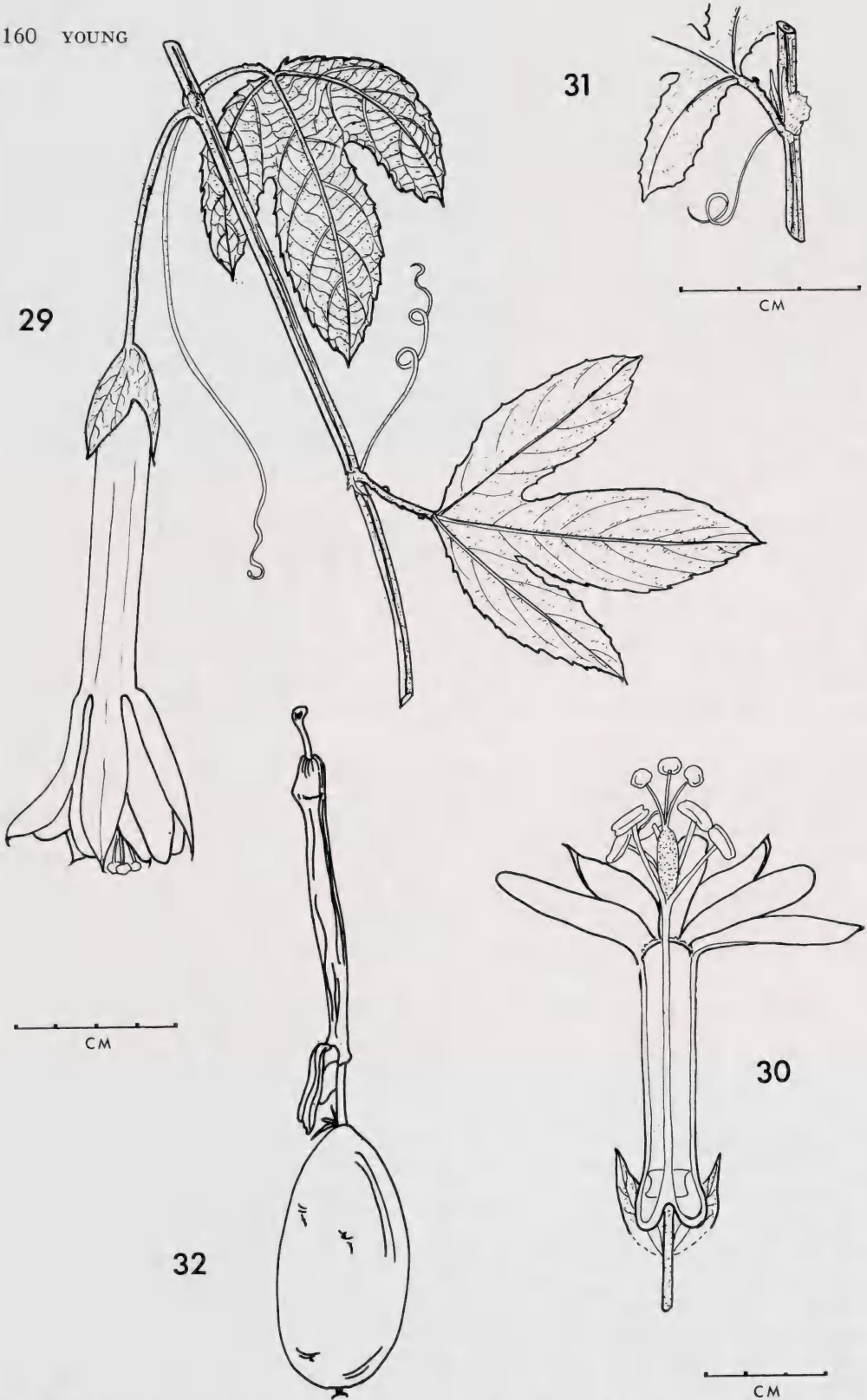


Fig. 29 Flowering branch of 116088, *P. mollissima* (HBK.) L. H. Bailey, flower not fully open; 30 fully open flower in longitudinal section; 31 node with stipules, a tendril and leaf; 32 fruit.

Seed and cuttings were collected by Dr. R. F. R. McNabb from garden escapes at Godley Road and Bishop's Reserve, Titirangi, and raised at the Plant Diseases Division, DSIR, Mt Albert.

Identification was made from the descriptions and illustrations of J. D. Hooker (1869, tab. 5750 and 1870, tab. 5876) and Killip (1938, p. 293).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

- 116169, 116171 Godley Road, Titirangi, R. F. R. McNabb & B. R. Young, Mar 1966 (fl.).
 114976 PDD, Mt Albert, seedling ex Godley Road, B. R. Young, Apr 1967 (fl.).
 117563 same locality, collector and source, Jan 1968 (fl.). A duplicate of 117563 sent to Kew was identified as *P. mixta* Linn.f.

Last century, several authors described plants allied to *P. mixta* as distinct species, and Masters discussed these entities and reduced them to subspecies and varieties of *Tacsonia* (now *Passiflora*) *mixta* in a series of papers (1869, p. 388; 1870, p. 955; 1871, p. 629; 1872, p. 541 and 1877, p. 126).

In the last treatment (1877, p. 126) Masters listed three varieties cultivated in European gardens. These seem to have been distinguished:—

Tacsonia mixta Juss.

var. *speciosa* Mast.

Leaf lobes oblong-lanceolate, hooked-serrate; petioles with stalked glands; bracts downy, net-veined. Described originally as *Tacsonia speciosa* HBK. (1817, p. 143).

var. *quitensis* Mast.

Leaf lobes ovate, serrate; petioles with sessile glands; bracts velvety, veins obscure. This variety is shown in J. D. Hooker 1870, tab. 5876.

var. *eriantha* Mast.

Similar to var. *quitensis*, but more densely pubescent. Bracts conspicuously veined. This variety is shown in J. D. Hooker 1869, tab. 5750.

Killip (1938, p. 297) considered that it is impossible to recognise the species which have been segregated from *Passiflora mixta*, or to accept the subspecies and varieties proposed by Masters. Killip remarked that the characters assigned to the various taxa are inconstant and impossible to correlate, and he concluded that *P. mixta* hybridises freely in nature. He listed a number of variations in the pubescence of *P. mixta*, and published the new combination, *Passiflora mixta* var. *eriantha* (Benth.) Killip, with the diagnosis:

Stem glabrous; leaves densely white-or yellowish-lanate between the nerves and veins beneath; bracts white-lanate, at length glabrate; calyx tube grayish lanate.

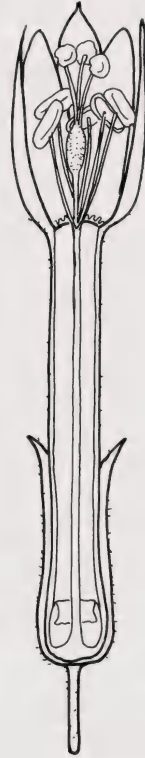
Several plants collected in New Zealand cannot be fitted into *P. mollissima*, *P. mixta*, or the various categories set out above. They are recorded in the Herbarium of the Auckland Institute and Museum:—

- 117562 PDD, Mt Albert, seedling of the Ruby Bay collection numbered 116088 and 116170 and identified at Kew as *P. mollissima*, B. R. Young, Jan 1968 (fl.). A duplicate of 117562 sent to Kew was identified as "*P. mixta* Linn.f. or a hybrid of this species with *P. mollissima* (HBK.) L. H. Bailey."
 117558 PDD, Mt Albert, seedling from a fruit of "*P. mollissima*", B. R. Young, Jan 1968 (fl.). A duplicate of 117558 sent to Kew was identified as *P. mixta* or a hybrid. Mr. P. S. Green noted that similar material at Kew is labelled as a cross between *P. mixta* and *P. pinnatistipula*, but it is hardly intermediate between the two species.
 116084 Windmill Road, Epsom, Miss J. Reid, Jan 1967 (fl. and fr.).
 116173 Paihia, Bay of Islands, R. Cumber, Mar 1966 (fl.).
 116174 Otahuhu, G. Young, Mar 1966 (fl.).



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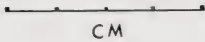


Fig. 33 Flowering branch of 114976, *P. mixta* Linn.f.; 34 longitudinal section of a flower; 35 node with leafy stipules and a leafstalk bearing stalked glands.

The Windmill Road, Paihia and Otahuhu collections resemble the seedling 117558, identified as *P. mixta* or a hybrid. All these specimens have bristle-like stipules about 4 mm long, often shed; sessile glands on the petioles; bracts up to 3.5 cm long, fused only at the base or to one-third of their length, spreading above; and calyx tubes only 6 cm long or less, markedly swollen at the base. These plants are known in the New Zealand nursery trade as *P. mollissima*, or the yellow banana passionfruit.

10. *Passiflora caerulea* L.

Figs. 36 - 38

In this species, the palmate leaves are 5-lobed (occasionally 3- or 7- or 9-lobed), the lobes being narrow and often glaucous. The bracts are free. The flowers, about 6 cm in diameter, are cup-shaped, with pink or white petals. The corona filaments are purple at the base, white at the middle, and blue at the tips. The fruit are ovoid to globose, up to 6 cm long, bright orange in colour, with deep red pulp. They are inedible. The species is a native of South America, occurring from Brazil to Argentine. It is grown in Auckland, and has been observed as a garden escape at Mangawhai, Warkworth, Takapuna, Coromandel and Thames.

Passiflora caerulea 'Constance Elliott', a large pure-white form described by Masters in 1884 (p. 700), is listed in New Zealand nursery catalogues (e.g. D. Hay & Son 1891, p. 12), but I have not found it.

Plants of *P. caerulea* were raised at Plant Diseases Division, DSIR, Mt Albert, from seed collected at Mr. C. Foster's farm, Warkworth.

Identification has been made from Killip's description (1938, p. 423) and the illustrations of Curtis (1786, tab. 28) and Masters (1884, p. 701).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

113918 Arran Street, Avondale, O. Beck, Mar 1964 (fl.).

117464 PDD, Mt Albert, B. R. Young, Nov 1967 (fl.). A duplicate of 117464 sent to Kew was identified as *P. caerulea* L.

119939 Mangawhai, on pines, A. N. Sexton, Feb 1969 (fl. and fr.).

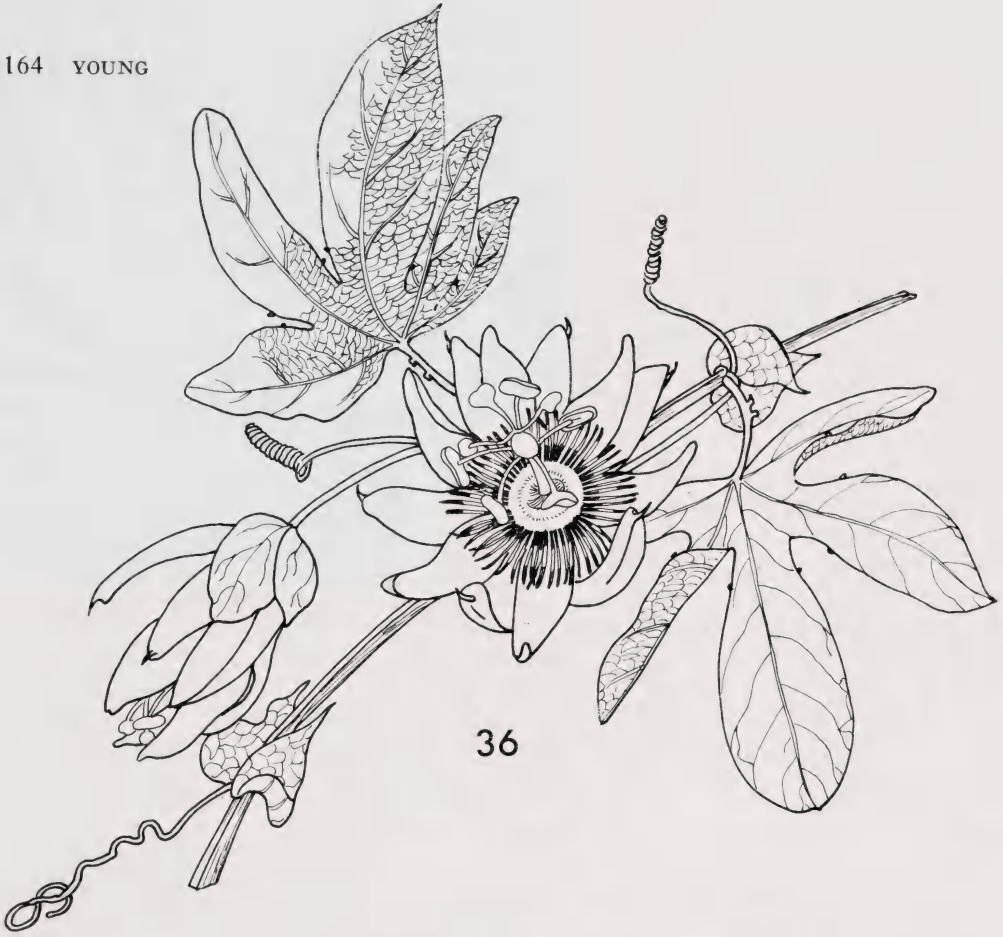
11. *Passiflora* 'Eynsford Gem'

Figs. 39 - 41

This cultivar is distinguished from *P. caerulea* by the 3-lobed leaves (often the two basal lobes are partially divided). The tendrils rarely exceed 5 mm in length, but some may grow up to 15 cm. Consequently, the plants have a scrambling rather than a climbing habit. The petals and sepals are lilac above, and the corona filaments are white tipped with purple. No fruit have been found.

This hybrid was raised by Mr. Geeson at Haldon House, near Exeter, England, about 1885, by crossing *Passiflora caerulea* 'Constance Elliott', a large white-flowered form of *P. caerulea*, and *P. racemosa*, a red-flowered species. It is grown in the warmer districts of New Zealand as an ornamental climber.

Plants for this study were obtained from the nursery of A. W. Palmer & Sons Ltd., Auckland.



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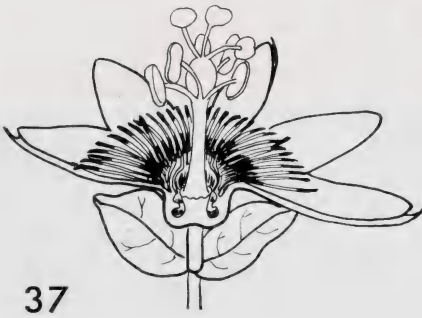


Fig. 36 Flowering branch of *P. caerulea* L.; 37 flower in longitudinal section; 38 fruit.



Fig. 39 Flowering shoot of *P.* 'Eynsford Gem'; 40 flower in longitudinal section; 41 bud.

Identification has been made from the description and illustration of Masters (1889, p. 492-3).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

116166 Palmer's Nursery, Auckland, B. R. Young, Apr 1966 (fl.).

114770 PDD, Mt Albert, B. R. Young, Apr 1967 (fl.). A duplicate of 114770 sent to Kew was identified as *P. caerulea* L., cv.

12. *Passiflora* x *alato-caerulea* Lindl.

Figs. 42 - 43

This hybrid differs from *P. caerulea* in that the leaves are 3-lobed, the lobes being broad, and red-veined beneath. It differs from *P. 'Eynsford Gem'* in being more robust, both in foliage and flowers. The stems are 4- or 5-angled, and the tendrils are well developed. The flowers are large and showy, 12 to 14 cm in diameter, with white sepals, tinged with lilac, and pale pink petals, also tinged with lilac. The corona filaments are purple at the base, banded with white and pink-lilac above, and tipped with white. Fruit are not formed.

Passiflora x *alato-caerulea* was raised by Mr. J. H. Masters at the nursery of Mr. W. Masters, Canterbury, England, in the early 1820s. He fertilised flowers of *P. alata* with pollen of *P. caerulea*, and obtained seed. Lindley mentioned in the description of *P. x alato-caerulea* (1824, p. 848) that among the seedlings were two variants, one with paler flowers and another much less in all its parts.

The epithet *pfordtii* was used for the hybrid some time before 1889 (Anon. 1889, p. 746), and X *Passiflora pfordtii* Hort. was formally described and illustrated by Degener in 1939 (Fam. 250). Lawrence (1960, p. 120 and 130) considers that the name *P. pfordtii* should be treated as a synonym of *P. x alato-caerulea* Lindl.

Cuttings of the hybrid were collected from Mr. Boot's garden at Warkworth, and a plant was obtained from the nursery of A. W. Palmer & Sons Ltd., Auckland. They match the descriptions and illustrations of *P. x alato-caerulea* Lindley and *P. pfordtii* Hort., but are known here as *P. 'Empress Eugene'*. This is a commercial synonym of *P. 'Impératrice Eugénie'* Lemaire. The specimens collected locally differ from Lemaire's description and illustration (1858, pl. 175) in several characters:—

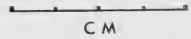
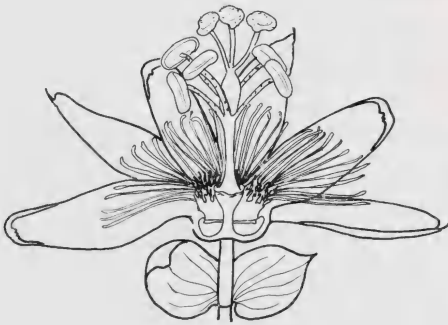
Plants collected at Warkworth and Auckland:	<i>P. 'Impératrice Eugénie'</i>
Stems angular.	Stems cylindrical.
Flowers scented.	Flowers not scented.
Corona filaments purple at base, banded with white and pink-lilac above, and tipped with white.	Corona filaments alternately striped with violet, blue and white.

Identification has been made from descriptions and illustrations of Lindley (1824, p. 848), Degener (1939, Fam. 250) and Lawrence (1960, p. 123).

Voucher specimens in the Herbarium of the Auckland Institute and Museum are:—

116156 Boot's garden, Warkworth, B. R. Young, Mar 1966 (fl.).

114469 PDD, Mt Albert, B. R. Young, Apr 1967 (fl.). A duplicate of 114469 sent to Kew was identified as "*P. x alato-caerulea* Lindl. and possibly the plant called *P. x munroi* Mast. (a synonym)."



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Fig. 42 Flowering branch of *P. x alato-caerulea* Lindl.; 43 flower in longitudinal section.

Other species and cultivars listed in New Zealand nursery catalogues have not been found. They include the following: *Passiflora alata*, *P. bounapartea*, *P. exoniensis*, *P. grandiflora*, *P. manacata*, *P. middletoniana*, *P. quadrangularis*, *P. sangwellii*, *P. 'Constance Elliott'*, *P. 'Fragrant Beauty'*, *P. 'Empress Eugene'* or *'Impératrice Eugénie'*, and *P. 'Oldfield Gem'*.

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